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⑥ DEFORMATION PROCESSING OF ANISOTROPIC METALS.

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⑮ Contract N0w 65-0124-d

⑨ Progress Report No. 3,

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1 Nov 1964 - 31 Dec 1964

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DEFORMATION PROCESSING OF ANISOTROPIC METALS

D. H. Avery and W. A. Backofen

During the past report period elevated-temperature tensile tests have ~~been~~ carried out on the alloy Zircaloy 4. As in the case of the Ti alloy 2.5 Sn-4 Al (~~Report No. 1~~), a very sharp maximum in strain rate sensitivity, ^{20% - 60%} ~~m~~, was found at or near the α - β transus, ~~Figure 1~~. Elongation values, ~~Figure 2~~, again correlated with strain rate sensitivity; however the maximum value of 220% was not as striking as in the titanium alloy.

Values of strain ratio, R , were high in Zircaloy 4 (approximately 4 at RT) and decreased with increasing testing temperature. For temperatures below 600°C, R was relatively constant with strain. In the range 600° to 800°C, R was found to increase remarkably after the onset of necking. In this temperature range necking occurred only in the width direction, leading to chisel-edged fractures showing 100% reduction in width and R values approaching infinity. ←

A sheet of HPS-20, cross-rolled sintered beryllium has been ordered. This material should be characterized by strong anisotropy with $[0002]$ along the sheet normal and high R values. One of the principle problems in beryllium technology lies in the very limited bend ductility at ordinary temperatures. Since sheet bending is a plane-strain operation, high R values and plane strain strengths would naturally be expected to impair ductility. Temperature dependence of deformation in plane strain will be of immediate experimental concern.

-/-

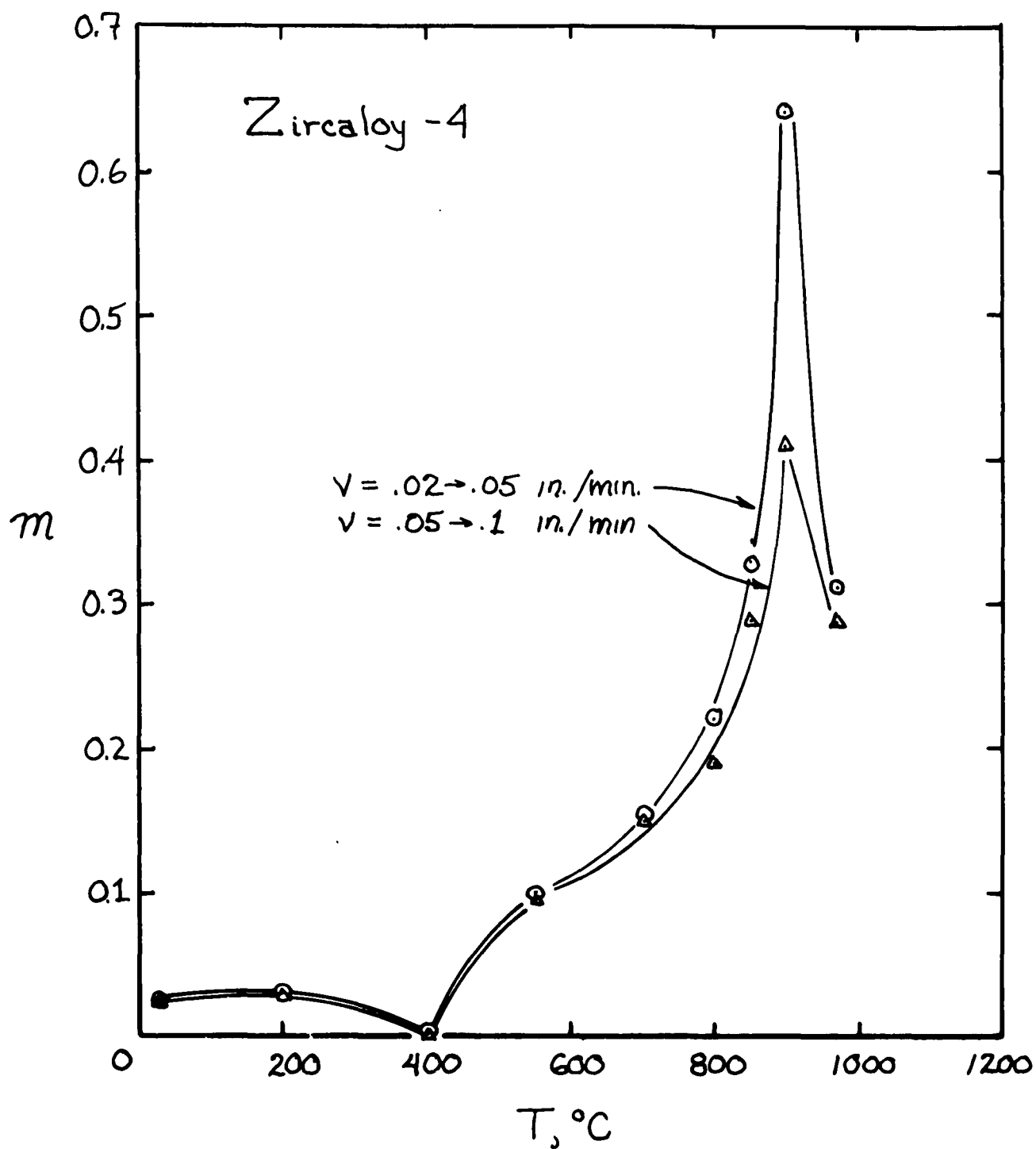


Figure 1. Strain Rate Sensitivity, m , Values versus Temperature for Zircaloy 4 at Two Pulling Velocities. m is the exponent in the empirical expression $\sigma = k\epsilon^m$.

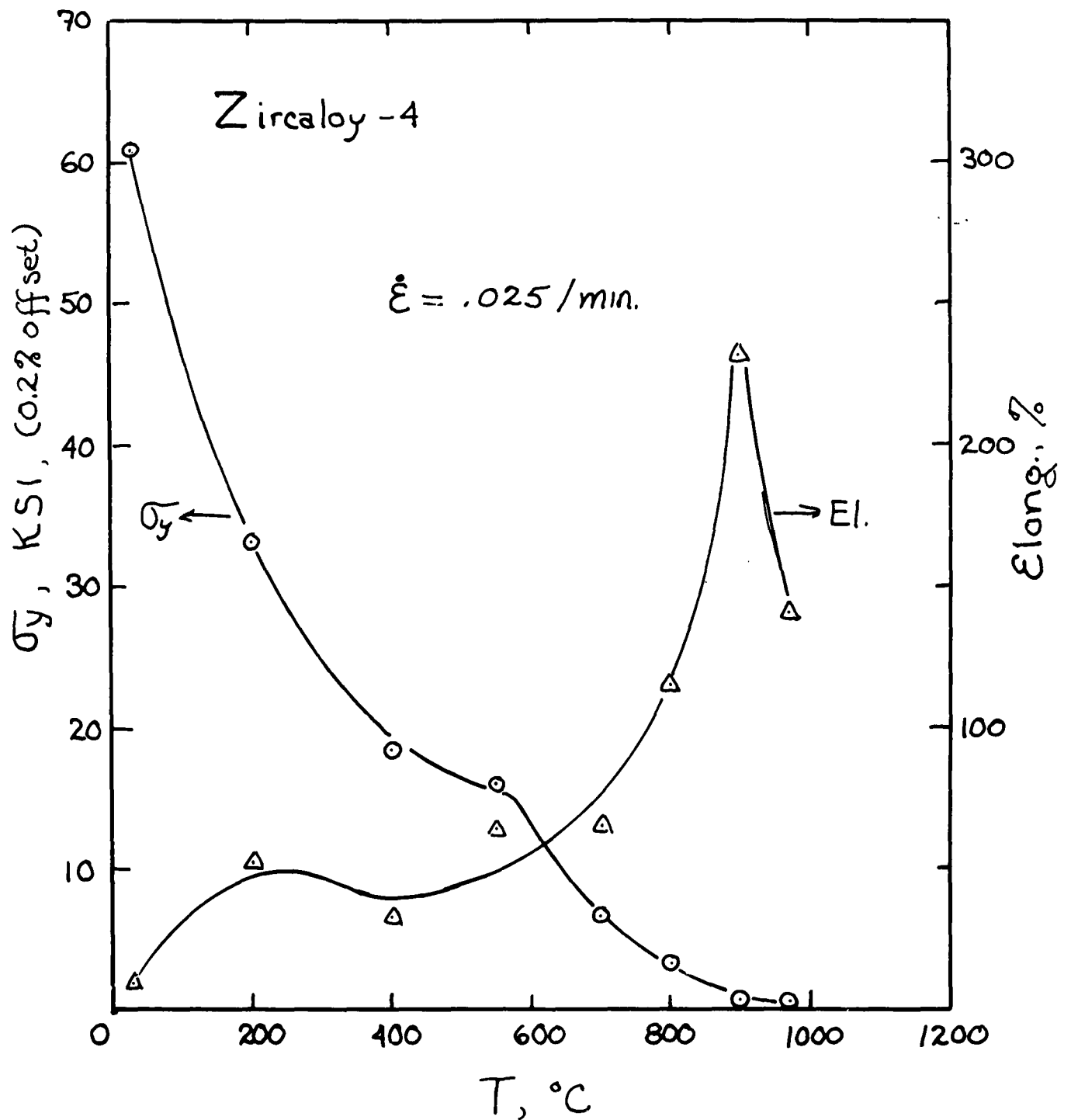


Figure 2. 0.2% Offset Yield Strength and Percent Elongation versus Temperature for Zircaloy 4. $\dot{\epsilon} = 0.025 \text{ min}^{-1}$.

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**Effect of Crystallographic Textures of Several
Anisotropic Metals on Design and Operation of
Deformation Processing Systems**

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